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Optimal modes for the laser cooling of solids

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Abstract

The method of the nonequilibrium statistical operator is employed to derive the kinetic equations for the numbers of phonons and photons and the collective population difference of the working transition that describe the laser cooling of solids. These equations are used to obtain the expressions for the efficiency of an optical heat engine in the inverse thermodynamic cycle and the limiting cooling temperature. Based on these expressions, the criteria for determining the type of the samples and the temperature and spectral ranges for the laser cooling experiments are formulated. The results of the numerical calculations are presented as supporting evidence. © Nauka/Interperiodica 2006.

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